

# STIC Search Report

## EIC 2800

STIC Database Tracking Number: 137303

TO: Dung T Nguyen  
Location: JEF 5C15  
Art Unit : 2828  
Friday, November 12, 2004

Case Serial Number: 10/025866

From: Irina Speckhard  
Location: EIC 2800 JEF 4B59  
Phone: (571) 272-2554  
[irina.speckhard@uspto.gov](mailto:irina.speckhard@uspto.gov)

### Search Notes

Examiner Nguyen,

Please find attached prior-art search results from the patent and non-patent abstract and full-text databases. The results were based on claims and statements of technical problems and solutions. Tagged records might be worth your review as well as the rest of the references provided.

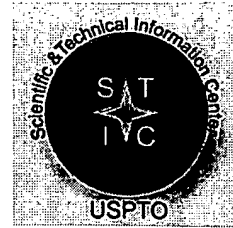
If you need further searching or have questions or comments, please let me know.

Thank you,

Irina Speckhard

# EIC2800

## Fast & Focused Search Feedback Form



The search results generated for your *Fast & Focused* search request are attached.

If you have any questions or comments about the scope or the results of the search, please contact *the EIC searcher* who conducted the search *or contact*:

[Jeff.Harrison@uspto.gov](mailto:Jeff.Harrison@uspto.gov) , EIC2800 Team Leader, 272-2511

### Voluntary Results Feedback Form

➤ I am an examiner in Workgroup:  Example: 2810

➤ Were you satisfied with the coverage and search strategies of this search? ☐ YES ☐ NO  
Why/Why Not?

➤ Relevant prior art found, search results used as follows:

☐  
☐

102 rejection

103 rejection

☐  
☐

Cited as being of interest.

Helped examiner better understand the invention.

☐

Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

☐  
☐

Foreign Patent(s)

Non-Patent Literature (journal articles, conference proceedings, etc.)

➤ Relevant prior art not found:

☐  
☐

Results verified the lack of relevant prior art (helped determine patentability).

Search results were not useful in determining patentability or understanding the invention.

Comments:

Best Available Copy

137 303

**SEARCH REQUEST FORM** Scientific and Technical Information Center - EIC2800  
Rev. 3/15/2004 This is an experimental format -- Please give suggestions or comments to Jeff Harrison, JEF-4B68, 272-2511.

Date 11/09/04 Serial # 10/025866 Priority Application Date 11/28/01  
Your Name NGUYEN DUNG T Examiner # 79581  
AU 2828 Phone 21949 Room FLOOR 5 - C15  
In what format would you like your results? Paper is the default. ☒ PAPER ☐ DISK ☐ EMAIL

If submitting more than one search, please prioritize in order of need.

The EIC searcher normally will contact you before beginning a prior art search. If you would like to sit with a searcher for an interactive search, please notify one of the searchers.

Where have you searched so far on this case? 11-03-04 11:57 AM  
Circle: USPT DWPI EPO Abs JPO Abs IBM TDB  
Other: \_\_\_\_\_

What relevant art have you found so far? Please attach pertinent citations or Information Disclosure Statements. \_\_\_\_\_

What types of references would you like? Please checkmark:

Primary Refs \_\_\_\_\_ Nonpatent Literature \_\_\_\_\_ Other \_\_\_\_\_  
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Teaching Refs \_\_\_\_\_

What is the topic, such as the novelty, motivation, utility, or other specific facets defining the desired focus of this search? Please include the concepts, synonyms, keywords, acronyms, registry numbers, definitions, structures, strategies, and anything else that helps to describe the topic. Please attach a copy of the abstract and pertinent claims.

**Staff Use Only**

Searcher: Speckhard  
Searcher Phone: \_\_\_\_\_  
Searcher Location: STIC-EIC2800, JEF-4B68  
Date Searcher Picked Up: 11/12/04  
Date Completed: 11/12/04  
Searcher Prep/Rev Time: 60  
Online Time: 60

**Type of Search**

Structure (H) \_\_\_\_\_  
Bibliographic ☒  
Litigation \_\_\_\_\_  
Patent ☒  
Patent Family ☒  
Other: creat

**Vendors**

STN \_\_\_\_\_  
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Other: \_\_\_\_\_

11/12/2004

10/025,866

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\*File 350: For more current information, include File 331 in your search. Enter HELP NEWS 331 for details.

File 347:JAPIO Nov 1976-2004/Jul(Updated 041102)  
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\*File 347: JAPIO data problems with year 2000 records are now fixed. Alerts have been run. See HELP NEWS 347 for details.

File 344:Chinese Patents Abs Aug 1985-2004/May  
(c) 2004 European Patent Office

File 371:French Patents 1961-2002/BOPI 200209  
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\*File 371: This file is not currently updating. The last update is 200209.

11/12/2004

10/025,866

Set	Items	Description
S1	2551	GAIN(2W)COUPL?
S2	24950	COUPL?(3N)COEFFICIENT? ? OR KL()IM OR IM(3N) (COUPL? OR GAI-
		N? OR COEFFICIENT? ?)
S3	25627	(DECIBEL OR DB) (3N) (COUPL? OR GAIN)
S4	242	S1 AND S2
S5	8	S4 AND S3
S6	3	RD (unique items)
S7	30596	(DECIBEL OR DB) (3N) (COUPL? OR GAIN OR REDUC?)
S8	171780	GRATE???? OR GRATING
S9	42640	RECEIV?(3N)POWER?
S10	4667	POWER?(3N)PENALT?
S11	8	S4 AND S7
S12	105	S4 AND S8
S13	0	S12 AND S9
S14	0	S12 AND S10
S15	105	S12 AND LASER?
S16	82	S15 AND DFB(3N)LASER?
S17	749	S2 AND DFB(3N)LASER?
S18	384	S17 AND S8
S19	82	S18 AND S1
S20	0	S19 AND S10
S21	0	S19 AND S9
S22	47	RD S19 (unique items)

6/3,AB/1 (Item 1 from file: 2)  
DIALOG(R)File 2:INSPEC  
(c) 2004 Institution of Electrical Engineers. All rts. reserv.

7852041 INSPEC Abstract Number: A2004-05-4265C-004, B2004-03-4320F-021  
Title: Small-core As-Se fiber for Raman amplification  
Author(s): Thielen, P.A.; Shaw, L.B.; Pureza, P.C.; Nguyen, V.Q.; Sanghera, J.S.; Aggarwal, I.D.  
Author Affiliation: SFA Inc., Largo, MD, USA  
Journal: Optics Letters vol.28, no.16 p.1406-8  
Publisher: Opt. Soc. America,  
Publication Date: 15 Aug. 2003 Country of Publication: USA  
CODEN: OPLEDP ISSN: 0146-9592  
SICI: 0146-9592(20030815)28:16L:1406:SCFR;1-Y  
Material Identity Number: 0053-2003-017  
Language: English

Abstract: We have demonstrated Raman amplification in small-core As-Se fiber. More than 20-dB of gain was observed in a 1.1-m length of fiber pumped by a nanosecond pulse of ~10.8-W peak power at 1.50  $\mu$ m. The peak of the Raman gain occurred at a shift of ~240  $\text{cm/sup -1/}$ . The Raman gain coefficient is estimated to be ~2.3\*10/sup -11/ m/W, which is more than 300 times greater than that of silica. The large Raman gain coefficient coupled with the large IR transparency window of these fibers shows promise for development of As-Se Raman fiber lasers and amplifiers in the near-, mid-, and long-IR spectral regions.

Subfile: A B  
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DIALOG(R)File 2:INSPEC  
(c) 2004 Institution of Electrical Engineers. All rts. reserv.

7316281 INSPEC Abstract Number: A2002-16-4265C-006, B2002-08-4320F-008  
Title: Raman amplification in As-Se fiber  
Author(s): Thielen, P.A.; Shaw, L.B.; Pureza, P.C.; Nguyen, V.Q.; Sanghera, J.S.; Aggarwal, I.D.  
Author Affiliation: SFA Inc., Largo, MD, USA  
Journal: Proceedings of the SPIE - The International Society for Optical Engineering Conference Title: Proc. SPIE - Int. Soc. Opt. Eng. (USA)  
vol.4628 p.74-7  
Publisher: SPIE-Int. Soc. Opt. Eng.,  
Publication Date: 2002 Country of Publication: USA  
CODEN: PSISDG ISSN: 0277-786X  
SICI: 0277-786X(2002)4628L:74:RAF;1-X  
Material Identity Number: C574-2002-181  
U.S. Copyright Clearance Center Code: 0277-786X/02/\$15.00  
Conference Title: Nonlinear Materials: Growth, Characterization, Devices, and Applications  
Conference Sponsor: SPIE  
Conference Date: 21 Jan. 2002 Conference Location: San Jose, CA, USA  
Language: English

Abstract: We have demonstrated Raman amplification in small core As-Se fiber. We observed over 20 dB of gain in a 1.1-meter length of fiber pumped by a nanosecond pulse of approximately 10.8 W peak power at 1.50  $\mu$ m. The peak of the Raman gain was shifted by approximately 230  $\text{cm/sup -1/}$  to 1.56  $\mu$ m. The Raman gain coefficient is estimated to be about 2.3\*10/sup -11/ m/W, over 300 times greater than that of silica. The large Raman gain coefficient coupled with the large IR transparency window of these fibers shows promise for development of As-Se

Raman fiber lasers and amplifiers in the near, mid and long IR spectral regions.

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DIALOG(R)File 8: Ei Compendex(R)

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05479681

E.I. No: EIP00025041025

Title: Strongly **gain-coupled** (SGC) coolerless ( minus 40 degree C approx. plus 85 degree C) MQW DFB lasers

Author: Hong, J.; Blaauw, C.; Moore, R.; Jatar, S.; Dzioba, S.

Corporate Source: Nortel, Ottawa, Ont, Can

Source: IEEE Journal on Selected Topics in Quantum Electronics v 5 n 3 May-Jun 1999. p 442-448

Publication Year: 1999

CODEN: IJSQEN ISSN: 1077-260X

Language: English

Abstract: Single-mode operation in a wide temperature range ( minus 40 degree C approx. plus 85 degree C) has been obtained, from an etched-QW strongly **gain-coupled** (SGC) distributed-feedback laser at 1.3 mu m. The SGC lasers exhibit an excellent sidemode-suppression-ratio (SMSR) of around 45-55 dB in continuous-wave operation, and a very good transient SMSR (TSMSR) of more than 35 dB during a **gain**-switched operation, both are over the entire temperature range. When mounted P-side up, the threshold current is about 12 mA at room temperature and 28 mA at plus 85 degree C. The output power is more than 20 mW with only 120-mA injection current at plus 85 degree C. (Author abstract) 8 Refs.

22/3,AB/1 (Item 1 from file: 2)  
DIALOG(R)File 2:INSPEC  
(c) 2004 Institution of Electrical Engineers. All rts. reserv.

7881397 INSPEC Abstract Number: A2004-07-4255P-016, B2004-04-4320J-025  
Title: Enhanced wavelength shift in partly **gain-coupled** distributed feedback lasers using quantum well intermixing  
Author(s): Zhan, L.; Chan, K.S.; Pun, E.Y.B.; Ho, H.P.  
Author Affiliation: Dept. of Electron. Eng., Hong Kong Univ., China  
Journal: Optics Communications vol.228, no.1-3 p.167-75  
Publisher: Elsevier,  
Publication Date: 1 Dec. 2003 Country of Publication: Netherlands  
CODEN: OPCOB8 ISSN: 0030-4018  
SICI: 0030-4018(20031201)228:1/3L:167:EWSP;1-4  
Material Identity Number: 0015-2003-023  
U.S. Copyright Clearance Center Code: 0030-4018/03/\$30.00  
Language: English

Abstract: In this paper, we present a theoretical study on the properties of wavelength shift due to quantum well (QW) intermixing in the partly **gain-coupled** distributed feedback lasers. A maximum possible wavelength red-shift of 9.2 nm is predicted if using a proper DFB grating, whose period is smaller than that in the conventional DFB lasers. In contrast to the index-coupled lambda /4-shifted DFB lasers, no increase in carrier density is required to compensate for the gain reduction due to QW intermixing, as the threshold gain in the partly **gain-coupled DFB laser** decreases with QW intermixing because of the increase in the coupling coefficient. The infected threshold current density for lasing is considerably flat in the wavelength red-shift range. The result is important as it indicates that the QW intermixing technique may be used in the fabrication of the equal threshold **DFB lasers** with different wavelengths in the monolithically integrated laser arrays.

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7800981 INSPEC Abstract Number: A2004-02-4255P-011, B2004-01-4320J-052  
Title: Characteristics of GaAs/AlGaAs quantum-wire distributed-feedback lasers with different gain modifications  
Author(s): Tae Geun Kim  
Author Affiliation: Dept. of Semicond. & New Mater. Eng., Kwangwoon Univ., Seoul, South Korea  
Journal: Journal of the Korean Physical Society vol.42, no.6 p. 791-4  
Publisher: Korean Phys. Soc,  
Publication Date: June 2003 Country of Publication: South Korea  
CODEN: KPSJAS ISSN: 0374-4884  
SICI: 0374-4884(200306)42:6L:791:CGAQ;1-J  
Material Identity Number: J068-2003-011  
Language: English

Abstract: GaAs/AlGaAs quantum-wire (QWR) **gain-coupled** distributed-feedback (GC-DFB) **lasers** were fabricated and characterized. Interestingly, as the shape of the active grating was varied, the lasing characteristics changed greatly; for example, one laser with sharp gratings lased at a threshold current of 13 mA while another one with dull gratings lased at 230 mA. This may be due to a change in the



gain coupling coefficient with the shape of the QWR active grating. Little observation of the stopband and the wavelength consistency between the lasing and the photoluminescence peaks of the QWRs also provided evidence for lasing via GC-DFB effects in these devices.

Subfile: A B

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DIALOG(R)File 2:INSPEC

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7600592 INSPEC Abstract Number: A2003-11-4255M-005, B2003-06-4320E-003

Title: Numerical simulation of a pulsed laser pumped distributed-feedback waveguided dye laser by coupled-wave theory

Author(s): Zuo, D.; Oki, Y.; Maeda, M.

Author Affiliation: Graduate Sch. of Inf. Sci. & Electr. Eng., Kyushu Univ., Fukuoka, Japan

Journal: IEEE Journal of Quantum Electronics vol.39, no.5 p.673-80

Publisher: IEEE,

Publication Date: May 2003 Country of Publication: USA

CODEN: IEJQA7 ISSN: 0018-9197

SICI: 0018-9197(200305)39:5L:673:NSPL;1-X

Material Identity Number: I105-2003-004

U.S. Copyright Clearance Center Code: 0018-9197/03/\$17.00

Language: English

Abstract: A dynamic model of pulsed laser pumped distributed-feedback (DFB) waveguided dye laser based on a coupled-wave theory is described. Due to the periodical distribution of the intensities of pump source and stimulated emission along the waveguide, the rate equations of the population densities are turned into the equations of the Fourier coefficients. Coupled-wave equations of optical fields are used to simulate the laser oscillation. Besides the temporal evolution of the output intensity, the spectra can also be obtained by the Fourier transform of the optical fields. Two different configurations of the waveguided dye laser, prefabricated DFB (mainly index coupling), first- and second-order holographic DFB (dynamic gain-coupling), are considered in the model. The simulation shows that: 1) the temporal waveforms of the holographic DFB consist of sharp spikes; 2) the broadened spectral widths resulted from the possible nonuniformities in propagation constant or grating period are less than 50 pm except for the second-order holographic DFB; and 3) strong parasitic oscillations can be observed in the second-order holographic DFB with terminal reflection. These results and the comparisons of some of them to the experiments are reported.

Subfile: A B

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22/3,AB/4 (Item 4 from file: 2)

DIALOG(R)File 2:INSPEC

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6564978 INSPEC Abstract Number: A2000-10-4260B-024, B2000-05-4320J-126, C2000-05-7320-072

Title: LAPAREX-an automatic parameter extraction program for gain- and index-coupled distributed feedback semiconductor lasers, and its application to observation of changing coupling: coefficients with currents

Author(s): Nakura, T.; Nakano, Y.

Author Affiliation: Dept. of Electron. Eng., Tokyo Univ., Japan  
Journal: IEICE Transactions on Electronics vol.E83-C, no.3 p.488-95  
Publisher: Inst. Electron. Inf. & Commun. Eng,  
Publication Date: March 2000 Country of Publication: Japan  
CODEN: IELEEJ ISSN: 0916-8524  
SICI: 0916-8524(200003)E83C:3L:488:LAPE;1-K  
Material Identity Number: P712-2000-004  
Language: English

Abstract: A reliable and automatic parameter extraction technique for **DFB lasers** is developed. The parameter extraction program which is named "LAPAREX" is able to determine many device parameters from a measured sub-threshold spectrum only, including **gain-** and **index-coupling coefficients**, and spatial phases of the **grating** at front and rear facets. Injection current dependence of **coupling coefficients** in a **gain-coupled DFB-laser** is observed, for the first time, by making use of it.

Subfile: A B C

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22/3,AB/5 (Item 5 from file: 2)

DIALOG(R)File 2:INSPEC

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6385378 INSPEC Abstract Number: A1999-23-4260B-005, B1999-12-4320J-016

Title: Optimization of **grating** structures in complex-coupled MQW **DFB lasers** with absorptive gratings

Author(s): Sung-Chan Cho; Dong-Chan Rhee; Boo-Gyoun Kim

Author Affiliation: Dept. of Electron. Eng., Soongsil Univ., South Korea

Journal: Journal of the Institute of Electronics Engineers of Korea D  
vol.36-D, no.7 p.80-91

Publisher: Inst. Electron. Eng. Korea,

Publication Date: July 1999 Country of Publication: South Korea

CODEN: CKODF8 ISSN: 1226-5845

SICI: 1226-5845(199907)36D:7L:80:OGSC;1-J

Material Identity Number: G412-1999-011

Language: Korean

Abstract: We present various optimal **grating** structures which give low threshold gain, good modulation characteristics, small effective linewidth enhancement factor, and large fabrication tolerance in complex-coupled MQW **DFB lasers** with absorptive gratings. To obtain these, we calculate the complex **coupling coefficients** using the extended additional layer method and the threshold gain including the modal loss in the absorptive **grating** region for rectangular and trapezoidal gratings. Based on the comparison of the results for various possible absorptive **grating** structures, the design guidelines are presented to obtain the low threshold gain or large fabrication tolerance. Among the **grating** structures studied, the double **grating** structure consisting of the absorptive **grating** on the index **grating** has the largest fabrication tolerance for the threshold **gain** and the **coupling** strength. The fabrication tolerance for the coupling ratio is very large for all the **grating** structures studied.

Subfile: A B

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22/3,AB/6 (Item 6 from file: 2)

DIALOG(R)File 2:INSPEC

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6380052 INSPEC Abstract Number: A1999-22-4255P-071, B1999-11-4320J-148  
Title: High-power single longitudinal mode operation of distributed feedback laser diodes with a decoupled confinement heterostructure  
Author(s): Okada, S.; Fujimoto, T.; Yamada, Y.; Yamada, Y.; Okubo, A.; Muro, K.  
Author Affiliation: Electron. & Inf. Mater. Lab., Mitsui Chem. Inc., Chiba, Japan  
Journal: Review of Laser Engineering vol.27, no.7 p.484-9  
Publisher: Laser Soc. Japan,  
Publication Date: July 1999 Country of Publication: Japan  
CODEN: REKEDA ISSN: 0387-0200  
SICI: 0387-0200(199907)27:7L:484:HPSL;1-1  
Material Identity Number: M701-1999-008  
Language: Japanese

Abstract: A new design of a real-index-guided distributed feedback laser diode (DFB-LD) based on a decoupled confinement heterostructure (DCH) has been proposed and the characteristics of high power single longitudinal and lateral mode operation have been investigated. A grating was located at the interface under the current blocking layer embedded in the GaAs waveguide, so that the current injection path was kept free from contamination during the fabrication processes. A single longitudinal and lateral mode operation up to 400 mW has been achieved at 25 degrees C, CW condition. The oscillation wavelength was around 978 nm and its temperature dependence was 0.087 nm/K. With increasing output power, the oscillating longitudinal mode shifts moderately (0.0023 nm/mW) to longer wavelength undergoing a few mode hops. The specific features of DCH such as low thermal and electrical resistance and a low gain coupling coefficient may contribute to suppression of the thermal disturbance and the hole-burning effect, and thus lead to an extremely high power single mode operation.

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6285978 INSPEC Abstract Number: A1999-15-4255P-071, B1999-08-4320J-078  
Title: 1.5  $\mu$ m InGaAsP/InP strained MQW gain-coupled DFB laser with an improved periodically modulated injection-carrier grating  
Author(s): Yi Luo; Guo-Peng Wen; Yu-Nong Gan; Ke-Qian Zhang; Sudoh, T.K.; Sudo, S.; Nakano, Y.; Tada, K.  
Author Affiliation: Dept. of Electron. Eng., Tsinghua Univ., Beijing, China  
Journal: Journal of the Korean Physical Society Conference Title: J. Korean Phys. Soc. (South Korea) vol.34, suppl.issue p.S101-3  
Publisher: Korean Phys. Soc.,  
Publication Date: April 1999 Country of Publication: South Korea  
CODEN: KPSJAS ISSN: 0374-4884  
SICI: 0374-4884(199904)34+L:s101:ISGC;1-P  
Material Identity Number: J068-1999-006  
Conference Title: Proceedings of 1998 Asian Science Seminar, International Workshop on Physics and Applications of Semiconductor Quantum Structures  
Conference Date: 18-23 Oct. 1998 Conference Location: Cheju, South Korea  
Language: English -

Abstract: A 1.55  $\mu\text{m}$  InGaAsP/InP strained multiple quantum well (MQW) distributed feedback (DFB) laser with an improved periodically modulated injection-carrier grating is reported for the first time. In this laser structure, the effect of the current blocking grating is enhanced by optimizing the doping level of its surrounding layers, therefore a large gain coupling coefficient can be expected. The device is fabricated by hybrid growth of MOVPE and LPE. A single-mode oscillation yield as high as 80% is achieved under the condition of two cleaved facets.

Subfile: A B

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22/3,AB/8 (Item 8 from file: 2)

DIALOG(R)File 2:INSPEC

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5988327 INSPEC Abstract Number: A9818-4255P-008, B9809-4320J-077

Title: Feasibility study on the application of the quantum disk to the gain-coupled distributed feedback laser

Author(s): Susa, N.

Author Affiliation: NTT Opto-Electron. Labs., Kanagawa, Japan

Journal: IEEE Journal of Quantum Electronics vol.34, no.8 p.1317-24

Publisher: IEEE,

Publication Date: Aug. 1998 Country of Publication: USA

CODEN: IEJQA7 ISSN: 0018-9197

SICI: 0018-9197(199808)34:8L.1317:FSAQ;1-L

Material Identity Number: I105-98008

U.S. Copyright Clearance Center Code: 0018-9197/98/\$10.00

Language: English

Abstract: This numerical study investigated the possibility of using quantum disks in a gain-coupled distributed feedback (DFB) laser, specifically whether the laser would oscillate when the number of electrons in a disk ( $N_{\text{th}}$ ) is less than the maximum possible number of electrons in the disk (i.e., oscillate at a threshold material gain ( $g_{\text{th}}$ ) less than the maximum peak material gain for each quantum disk). The influences of the disk diameter and thickness, the number of disks stacked vertically in a layer ( $N_{\text{st}}$ ), the device length, the period perpendicular to the light propagation direction, and facet reflectivity on the  $g_{\text{th}}$ , the threshold current density ( $J_{\text{th}}$ ), and the normalized gain-coupling coefficient ( $K_{\text{g/L}}$ ) were also examined. When  $N_{\text{st}}$  is increased,  $g_{\text{th}}$  decreases to less than the value estimated when assuming that the product of  $g_{\text{th}}$  and  $N_{\text{st}}$  is constant. Although closely spaced disks are useful for reducing  $g_{\text{th}}$ , there is an optimum disk distribution minimizing  $J_{\text{th}}$ , and this distribution depends on the parameters described above. The  $J_{\text{th}}$  also depends on the disk size and is smallest when the diameter is 6 nm. The magnitude of  $K_{\text{g/L}}$  is about 0.76 and is independent of the height of the gain grating (i.e.,  $N_{\text{st}}$ ), but it can be controlled by adjusting the disk diameter and the facet reflectivity.

Subfile: A B

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22/3,AB/9 (Item 9 from file: 2)

DIALOG(R)File 2:INSPEC

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5936634 INSPEC Abstract Number: A9814-4255P-020, B9807-4320J-064

Title: A coupled mode analysis of complex coupled DFB lasers

Author(s): Zakery, A.; Zare, R.; Bakhtazad, A.  
Author Affiliation: Dept. of Phys., Shiraz Univ., Iran  
Journal: International Journal of Optoelectronics vol.11, no.5 p.  
345-51

Publisher: Taylor & Francis,  
Publication Date: Sept.-Oct. 1997 Country of Publication: UK  
CODEN: IJOEEV ISSN: 0952-5432  
SICI: 0952-5432(199709/10)11:5L:345:CMAC;1-6  
Material Identity Number: M510-98002  
U.S. Copyright Clearance Center Code: 0952-5432/97/\$12.00  
Language: English

Abstract: The superiority of **gain- or loss-coupled** distributed feedback (DFB) **lasers** over index coupled ones is evident in many respects. However, the fabrication of first-order **gain- or loss-coupled** gratings involves many difficulties. In fact, we are practically restricted to employing higher-order **gain- or loss-coupled** gratings, which are mixed with index-coupling. One of the main disadvantages of higher-order gratings is radiation loss. To take into account both the effects of higher-order modes on coupling and losses in a linear regime, we apply a well-known coupled wave analysis due to Streifer et al. To complex coupled **DFB lasers**. It leads to a pair of **coupled** wave equations, where **coefficients** indicate all the possible coupling and losses. The **coupling coefficient**  $\kappa$  and other **coupling coefficients**  $\zeta_i$ ,  $i=1, 2, 3, 4$  are obtained for a second-order rectangular loss **grating** where, in fact, the gain and index are in an antiphase position. Threshold conditions, and longitudinal modal patterns are obtained and discussed.

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22/3,AB/10 (Item 10 from file: 2)  
DIALOG(R)File 2:INSPEC  
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5745796 INSPEC Abstract Number: A9724-4260B-026, B9712-4320J-186  
Title: Characterization of excess noise induced by external reflection in 1.55  $\mu$  m **gain-coupled DFB lasers** of absorptive **grating** type

Author(s): Nakano, Y.; Funabashi, M.; Yatsu, R.; Nakura, T.; Tada, K.  
Author Affiliation: Dept. of Electron. Eng., Tokyo Univ., Japan  
Conference Title: 11th International Conference on Integrated Optics and Optical Fibre Communications 23rd European Conference on Optical Communications IOOC-ECOC 97 (Conf. Publ. No.448) Part vol.1 p.25-8 vol.1

Publisher: IEE, London, UK  
Publication Date: 1997 Country of Publication: UK 5 vol.  
(xiii+202+xvi+296+xviii+370+viii+120+vii+92) pp.  
ISBN: 0 85296 697 0 Material Identity Number: XX97-02523  
Conference Title: 11th International Conference on Integrated Optics and Optical Fibre Communications 23 European Conference on Optical Communications IOOC-ECOC97 (Conf. Publ. No.448)

Conference Sponsor: IEE  
Conference Date: 22-25 Sept. 1997 Conference Location: Edinburgh, UK  
Language: English  
Abstract: We have fabricated 1.55  $\mu$  m InGaAsP-InP strained multiple-quantum-well **gain-coupled DFB lasers** of absorptive **grating** type, and characterized their excess noise induced by external reflection from several meters. **Coupling coefficient** dependence of the critical feedback level is discussed.

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22/3,AB/11 (Item 11 from file: 2)  
DIALOG(R)File 2:INSPEC  
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5678715 INSPEC Abstract Number: A9719-4260B-029, B9710-4320J-121  
Title: Comparision of InGaAs absorptive **grating** structures in 1.55  
 $\mu\text{m}$  InGaAsP/InP strained MQW **gain-coupled DFB**  
**lasers**

Author(s): Funabashi, M.; Kawanishi, H.; Sudoh, T.K.; Nakura, T.;  
Schmitz, D.; Schulte, F.; Nakano, Y.; Tada, K.

Author Affiliation: Dept. of Electron. Eng., Tokyo Univ., Japan

Conference Title: Conference Proceedings. 1997 International Conference  
on Indium Phosphide and Related Materials (Cat. No.97CH36058) p.292-5

Publisher: IEEE, New York, NY, USA

Publication Date: 1997 Country of Publication: USA xii+680 pp.

ISBN: 0 7803 3898 7 Material Identity Number: XX97-01229

U.S. Copyright Clearance Center Code: 0 7803 3898 7/97/\$10.00

Conference Title: Conference Proceedings. 1997 International Conference  
on Indium Phosphide and Related Materials

Conference Sponsor: IEEE Lasers & Electro-Opt. Soc.; IEEE Electron  
Devices Soc

Conference Date: 11-15 May 1997 Conference Location: Cape Cod, MA, USA

Language: English

Abstract: In **gain-coupled** (GC) distributed-feedback ( **DFB**) **lasers** of absorptive **grating** type, the device characteristics depend very much on the absorptive **grating** configuration such as duty cycle, layer thickness, conduction type, and material composition. We have fabricated 1.55  $\mu\text{m}$  InGaAsP/InP strained multiple quantum well (MQW) **DFB lasers** having different absorptive **grating** thickness and different conduction type. Lasing characteristics of these lasers were compared with regard to **coupling coefficients** and absorption saturation. Through net gain measurement, information useful for designing and optimizing the absorptive **grating** was obtained.

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22/3,AB/12 (Item 12 from file: 2)  
DIALOG(R)File 2:INSPEC  
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5612981 INSPEC Abstract Number: A9715-4280R-002, B9708-4130-018

Title: **Coupling coefficients** of gratings with graded  
refractive index waveguides

Author(s): Chen, C.; Chen, L.; Wang, Q.

Author Affiliation: Inst. of Semicond., Acad. Sinica, Beijing, China

Journal: Optical and Quantum Electronics vol.29, no.5 p.539-53

Publisher: Chapman & Hall,

Publication Date: May 1997 Country of Publication: UK

CODEN: OQELDI ISSN: 0306-8919

SICI: 0306-8919(199705)29:5L:539:CCGW;1-L

Material Identity Number: 0044-97005

Language: English

Abstract: In this paper, the effective **coupling coefficient**  
 $k/\text{sub eff/}$  and the self-**coupling coefficient**  $\text{zeta /sub 1/}$  are

introduced to describe the characteristic of gratings in a resonant situation when the effects of radiation and other partial waves coupling are considered. The dependence of these two coupling coefficients on grating tooth shapes and depths and the dimensions of graded refractive index (GRIN) waveguides is numerically analysed. The results show that the gratings with linear GRIN waveguides have the largest K/sub eff/. The possibility of realizing a complex-coupled DFB laser, even a pure gain or loss coupled DFB laser, employing only a real refractive index coupled grating is also discussed.

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22/3,AB/13 (Item 13 from file: 2)

DIALOG(R)File 2:INSPEC

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5364681 INSPEC Abstract Number: A9620-4255P-038, B9610-4320J-124

Title: Side mode suppression ratio for 1.3  $\mu$ m loss coupled DFB lasers with large loss coupling coefficient

Author(s): Zhang, L.M.; Ackerman, D.A.; Hybertsen, M.S.

Author Affiliation: AT&T Bell Labs., Murray Hill, NJ, USA

Journal: Proceedings of the SPIE - The International Society for Optical Engineering Conference Title: Proc. SPIE - Int. Soc. Opt. Eng. (USA) vol.2693 p.636-9

Publisher: SPIE-Int. Soc. Opt. Eng,

Publication Date: 1996 Country of Publication: USA

CODEN: PSISDG ISSN: 0277-786X

SICI: 0277-786X(1996)2693L:636:SMSR;1-0

Material Identity Number: C574-96154

U.S. Copyright Clearance Center Code: 0 8194 2067 0/96/\$6.00

Conference Title: Physics and Simulation of Optoelectronic Devices IV

Conference Sponsor: SPIE

Conference Date: 29 Jan.-2 Feb. 1996 Conference Location: San Jose, CA, USA

Language: English

Abstract: Single mode yield is a substantial issue for distributed feedback (DFB) lasers manufactured with an HR facet reflection coating at one end to maximize the power output for telecommunications applications. It has been demonstrated that high single mode yield can be achieved by introducing the gain/loss coupled DFB. In this paper, we study the side mode suppression ratio (SMSR) of antiphase, loss coupled DFB laser with large loss coupling coefficient near and well above the lasing threshold. The injection current dependence of the side mode suppression ratio of an HR-AR facet coated loss-coupled DFB laser is examined through numerical simulation and experiments. The results show that, although the SMSR can be very good just above the threshold, a dramatic drop in the SMSR can occur due to the competition between the spatial hole burning and the loss in the grating at modest injection currents.

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22/3,AB/14 (Item 14 from file: 2)

DIALOG(R)File 2:INSPEC

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5042201 INSPEC Abstract Number: A9519-4255P-039, B9510-4320J-070

Title: **Gain-coupled strained layer MQW-DFB lasers**  
with an essentially simplified fabrication process for  $\lambda = 1.55 \mu m$   
Author(s): Rast, A.; Johannes, T.W.; Harth, W.; Rieger, J.  
Author Affiliation: Lehrstuhl für Allgemeine Elektrotechnik und  
Angewandte Elektronik, Tech. Univ. München, Germany  
Journal: IEEE Photonics Technology Letters vol.7, no.8 p.830-2  
Publication Date: Aug. 1995 Country of Publication: USA  
CODEN: IPTLEL ISSN: 1041-1135  
U.S. Copyright Clearance Center Code: 1041-1135/95/\$04.00  
Language: English  
Abstract: A **gain-coupled** (GC) strained-layer (SL)  
multi-quantum-well (MQW) distributed-feedback (DFB) **laser** with  
a metallized surface **grating** and a substantially simplified  
fabrication process made by single-step epitaxy without corrugation  
overgrowth is described. The complex **coupling coefficient** can  
be adjusted by the contact metallization. Room-temperature single-mode  
continuous-wave (CW) operation with a threshold current of 22 mA, an output  
power of 20 mW, and a linewidth of 2.5 MHz is demonstrated.  
Subfile: A B  
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22/3,AB/15 (Item 15 from file: 2)  
DIALOG(R)File 2:INSPEC  
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5000920 INSPEC Abstract Number: A9516-4260H-002, B9509-4330-002  
Title: Nonlinear analysis of a dielectric distributed feedback laser with  
complex **coupling coefficient**  
Author(s): Szczepanski, P.; Weglik, P.  
Author Affiliation: Inst. of Microelectron. & Optoelectron., Warsaw Univ.  
of Technol., Poland  
Journal: IEEE Journal of Quantum Electronics vol.31, no.7 p.1337-43  
Publication Date: July 1995 Country of Publication: USA  
CODEN: IEJQA7 ISSN: 0018-9197  
U.S. Copyright Clearance Center Code: 0018-9197/95/\$04.00  
Language: English  
Abstract: An approximate analysis of the nonlinear operation of **DFB**  
a dielectric **laser** with complex **coupling coefficient** is  
presented, An expression relating the small signal gain to the output power  
and the system parameters, including the spatial hole burning effect, is  
obtained. It is shown that the gain **grating**, the loss **grating**,  
and the higher order Bragg **grating** all contribute to laser operation  
above the threshold in a different manner. Moreover, it is possible to  
achieve a "negative" gain effect in the partly **gain-coupled**  
structure operating above the threshold, which depends on the output power  
level, the distributed loss level and the spatial hole burning effect.  
Subfile: A B  
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22/3,AB/16 (Item 16 from file: 2)  
DIALOG(R)File 2:INSPEC  
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4988484 INSPEC Abstract Number: A9515-4255P-004, B9508-4320J-039  
Title: Mode selection in complex-coupled semiconductor **DFB**  
**lasers**  
Author(s): Flanigan, B.J.; Carroll, J.E.  
Author Affiliation: Dept. of Eng., Cambridge Univ., UK



Journal: Electronics Letters vol.31, no.12 p.977-9  
Publication Date: 8 June 1995 Country of Publication: UK  
CODEN: ELLEAK ISSN: 0013-5194  
U.S. Copyright Clearance Center Code: 0013-5194/95/\$10.00  
Language: English

Abstract: Mode suppression in complex-coupled **DFB lasers** with both in-phase and antiphase gain gratings is examined through a novel use of power balance. The theory is then backed up by more detailed arguments using a dynamic time domain model. The phase of the gain **grating** in relation to the index **grating** determines which mode of the DFB is suppressed. Longitudinal variations in the **gain coupling coefficient** caused by spatial hole burning provide additional side-mode suppression mechanisms.

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22/3,AB/17 (Item 17 from file: 2)  
DIALOG(R)File 2:INSPEC  
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4955713 INSPEC Abstract Number: A9512-4260F-010, B9507-4320J-043

Title: Frequency modulation characteristics of absorptive-**grating gain-coupled DFB lasers** : spatial hole burning self-suppression effect

Author(s): Sudoh, T.K.; Nakano, Y.; Tada, K.; Kikuchi, K.; Hirata, T.; Hosomatsu, H.

Author Affiliation: Dept. of Electron. Eng., Tokyo Univ., Japan  
p.572-3

Publisher: IEEE, New York, NY, USA

Publication Date: 1993 Country of Publication: USA xxvi+832 pp.

ISBN: 0 7803 1263 5

Conference Title: Proceedings of LEOS '93

Conference Date: 15-18 Nov. 1993 Conference Location: San Jose, CA, USA

Language: English

Abstract: The spatial hole burning (SHB) in distributed feedback (**DFB lasers**) limits longitudinal-mode stability and occasionally results in spectral linewidth broadening or multiple-mode oscillation. Introduction of **gain coupling** is one of effective methods to reduce SHB. However, SHB may still exist in the **gain-coupled (GC) DFB laser** due to inappropriate coupling strength,

parasitic index coupling, and facet reflection in practical devices. This paper describes self-suppression effect of SHB in absorptive-**grating GC DFB lasers** which is observed through the measurement of

frequency modulation (FM) characteristics. This effect is attributed to the photon-density-dependent **coupling coefficient** in the **gain-coupled cavity**.

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22/3,AB/18 (Item 18 from file: 2)  
DIALOG(R)File 2:INSPEC  
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4752278 INSPEC Abstract Number: A9420-4260B-001, B9410-4320J-065

Title: Long-wavelength InGaAsP/InP multiquantum well distributed feedback and distributed Bragg reflector lasers grown by chemical beam epitaxy

Author(s): Tsang, W.T.; Wu, M.C.; Chen, Y.K.; Choa, F.S.; Logan, R.A.;

Chu, S.N.G.; Sergeant, A.M.; Magill, P.; Reichmann, K.C.; Burrus, C.A.

Author Affiliation: AT&T Bell Labs., Murray Hill, NJ, USA

Journal: IEEE Journal of Quantum Electronics vol.30, no.6 p.1370-80

Publication Date: June 1994 Country of Publication: USA

CODEN: IEJQA7 ISSN: 0018-9197

U.S. Copyright Clearance Center Code: 0018-9197/94/\$04.00

Language: English

**Abstract:** We demonstrated the successful operation of long-wavelength InGaAsP low threshold-current index-coupled and **gain-coupled DFB lasers** grown by chemical beam epitaxy (CBE). For index-coupled **DFB lasers**, buried-heterostructure six-QW **DFB lasers** (250  $\mu\text{m}$  long and as-cleaved) operated at 1.55  $\mu\text{m}$  with CW threshold currents 10-15 mA and slope efficiencies up to 0.35 mW/mA (both facets). A side-mode suppression ratio (SMSR) as high as 49 dB was obtained. The lasers operated in the same range even at high temperatures (70 degrees C checked). For **gain-coupled DFB lasers**, **gain-coupling** is accomplished by using a InGaAsP quaternary **grating** or quantum-well **grating** that absorbs the DFB emission. The use of a quantum-well **grating**, in particular, greatly facilitates the reproducible regrowth (defect-free) over **grating** and the control of the **coupling coefficient**. CW threshold currents were in the range of 10-15 mA for 250-  $\mu\text{m}$  and 13-18 mA for 250-  $\mu\text{m}$  and 500-  $\mu\text{m}$  cavities, respectively. Slope efficiencies were high, approximately 0.4 mW/mA (both facets). SMSR was as high as 52 dB and remained in the same DFB mode with SMSR staying approximately 50 dB throughout the entire current range. Linewidth\*power products of 1.9-4.0 were measured with minimum linewidths of 1.8-2.2 MHz. No detectable chirp was measured under 2.5 Gb/s modulation. Unlike index-coupled **DFB lasers** in which mode partition events decrease slowly even when biased above threshold, these lasers have mode partition events shut off sharply as bias approaches threshold ( $\approx 0.95 I_{\text{th}}$ ). A very small dispersion penalty of 1.0 dB was measured at 10/sup -11/ BER in transmission experiments using these lasers as sources at 1.7 Gb/s over an amplified fiber system of 230 km. No self-pulsation was observed in these **gain-coupled DFB lasers**. Gain-switching at 4 GHz with a 100% optical modulation depth and a FWHM pulse width of 23 ps was achieved with these **gain-coupled DFB lasers**. The peak power was approximately 72 mW and the FWHM bandwidth was 0.14 nm. We also fabricated InGaAs/InGaAsP multi-quantum-well DBR lasers by CBE. Taking advantage of uniform thickness growth and proper design of weak and long gratings, a record high SMSR of 58.5 dB was obtained.

Subfile: A B

22/3,AB/19 (Item 19 from file: 2)

DIALOG(R)File 2:INSPEC

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4344767 INSPEC Abstract Number: A9306-4260B-037, B9303-4320J-105

Title: Long wavelength InGaAsP/InP distributed feedback lasers grown by chemical beam epitaxy

Author(s): Tsang, W.T.; Choa, F.S.; Wu, M.C.; Chen, Y.K.; Logan, R.A.; Chu, S.N.G.; Sergeant, A.M.; Magill, P.; Reichmann, K.C.; Burrus, C.A.

Author Affiliation: AT&T Bell Lab., Murray Hill, NJ, USA

Journal: Journal of Crystal Growth Conference Title: J. Cryst. Growth (Netherlands) vol.124, no.1-4 p.716-22

Publication Date: Nov. 1992 Country of Publication: Netherlands

CODEN: JCRGAE ISSN: 0022-0248

Material Identity Number: J037-92018

U.S. Copyright Clearance Center Code: 0022-0248/92/\$05.00

Conference Title: Metalorganic Vapor Phase Epitaxy 1992. Sixth International Conference

Conference Sponsor: IEEE; American Assoc. Crystal Growth

Conference Date: 8-11 June 1992 Conference Location: Cambridge, MA, USA

Language: English

Abstract: The authors have demonstrated successful operation of long wavelength InGaAsP low threshold-current **gain-coupled DFB**

**lasers**. This is accomplished by using a InGaAsP quarternary **grating** or quantum well **grating** that absorbs the DFB emission. The use of a quantum well **grating**, in particular, greatly facilitates the reproducible regrowth (defect-free) over **grating** and the control of the **coupling coefficient**. CW threshold currents were in the range of 10-15 mA for 250  $\mu$ m and 13-18 mA for 250 and 500  $\mu$ m cavities, respectively. Slope efficiencies were high,  $\sim 0.4$  mW/mA (both facets). SMSR was as high as 52 dB and remained in the same DFB mode with SMSR staying  $\sim 50$  dB throughout the entire current range. Linewidth\*power products of 1.9-4.0 were measured with minimum linewidths of 1.8-2.2 MHz. No detectable chirp was measured under 2.5 Gb/s modulation. Unlike index-coupled DFB **lasers** in which mode partition events decrease slowly even when biased above threshold, these lasers have mode partition events shut off sharply as bias approaches threshold ( $> \text{or approximately} = 0.95 I_{\text{sub th}}$ ). A very small dispersion penalty of 1.0 dB was measured at  $10^{-11}$  BER in transmission experiments using these lasers as sources at 1.7 Gb/s over an amplified fiber system of 239 km. No self-pulsation was observed in these **gain-coupled DFB lasers**.

Subfile: A B

22/3,AB/20 (Item 20 from file: 2)

DIALOG(R)File 2:INSPEC

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03995002 INSPEC Abstract Number: A91126752, B91070365

Title: **Coupling coefficients in gain-coupled DFB lasers** : inherent compromise between coupling strength and loss

Author(s): David, K.; Buus, J.; Morthier, G.; Baets, R.

Author Affiliation: Lab. of Electromagn. & Acoust., Gent Univ., Belgium

Journal: IEEE Photonics Technology Letters vol.3, no.5 p.439-41

Publication Date: May 1991 Country of Publication: USA

CODEN: IPTLEL ISSN: 1041-1135

U.S. Copyright Clearance Center Code: 1041-1135/91/0500-0439\$01.00

Language: English

Abstract: A theoretical analysis of the **gain-coupling coefficient** for distributed feedback (DFB) **lasers** with first-order, rectangular, gain, or loss gratings is presented. For the structure with gain **grating**, the dependence of the **gain-coupling coefficient** on the modal gain has been taken into account for the first time. In both structures, an inherent compromise between coupling strength and extra modal loss is found. The results show that significant **gain-coupling coefficient** values are feasible.

Subfile: A B

22/3,AB/21 (Item 1 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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04890485

E.I. No: EIP97123960026

Title: Very low threshold and high power CW operation in 1.55  $\mu$ m **gain-coupled DFB lasers** with periodically etched quantum wells

Author: Talneau, A.; Charil, J.; Ougazzaden, A.

Corporate Source: France Telecom/CNET/DTT, Bagneux, Fr

Source: Electronics Letters v 33 n 22 Oct 23 1997. p 1881-1883

Publication Year: 1997

CODEN: ELLEAK ISSN: 0013-5194

Language: English

Abstract: The authors demonstrate extremely low threshold and high CW output power in 1.55  $\mu$ m **gain coupled DFB lasers**.

The structure is an MQW strain compensated active layer with first-order **grating** etched on the upper wells. The lowest thresholds of 2.5mA at 20 degree C and 10mA at 80 degree C are obtained using one HR facet coating. With an AR front facet, the CW output is increased up to 40mW, while the threshold current remains less than 10mA. (Author abstract) 5 Refs.

22/3,AB/22 (Item 2 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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04833510

E.I. No: EIP97103847155

Title: **Gain-coupled** distributed-feedback laser triode - novel structure for tuning **coupling coefficient**

Author: Kawanishi, Hidekazu; Fukuoka, Tetsuya; Nakano, Yoshiaki; Tada, Kunio

Corporate Source: Univ of Tokyo, Tokyo, Jpn

Conference Title: Proceedings of the 1997 Pacific Rim Conference on Lasers and Electro-Optics, CLEO/Pacific Rim

Conference Location: Chiba, Jpn Conference Date: 19970714-19970718

E.I. Conference No.: 46984

Source: Pacific Rim Conference on Lasers and Electro-Optics, CLEO - Technical Digest 1997. IEEE, Piscataway, NJ, USA. p 141

Publication Year: 1997

CODEN: 002223

Language: English

Abstract: A three-terminal **gain-coupled** (GC) distributed feedback (DFB) laser where the third terminal is connected to its absorptive **grating** controls **coupling coefficient**, absorption saturation in the **grating**, wavelength chirping, and linewidth enhancement factor. With this, Q switching and injection-current **grating** is also possible.

22/3,AB/23 (Item 3 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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04762128

E.I. No: EIP97073743836

Title: First observation of changing **coupling coefficients** in a **gain-coupled DFB laser** with absorptive **grating** by automatic parameter extraction from subthreshold spectra

Author: Nakura, Toru; Sato, Kenji; Funabashi, Masaki; Morthier, Geert; Baets, Roel; Nakano, Yoshiaki; Tada, Kunio

Corporate Source: Univ of Tokyo, Tokyo, Jpn  
Conference Title: Proceedings of the 1997 Conference on Lasers and Electro-Optics, CLEO  
Conference Location: Baltimore, MD, USA Conference Date: 19970518-19970523

E.I. Conference No.: 46669

Source: Conference Proceedings - Lasers and Electro-Optics Society Annual Meeting-CLEO v 11 1997. IEEE, Piscataway, NJ, USA, 97CH36110. p 399-400

Publication Year: 1997

CODEN: CPLSE4

Language: English

Abstract: The changing **coupling coefficients** in a **gain-coupled DFB laser** with an absorptive **grating** resulting from saturable absorption was made possible by the parameter extraction program. The index- and **gain-coupling coefficients**, effective refractive index and its wavelength dispersion, **grating** facet phases, and gain profile were determined based on the coupled wave equations and the transfer matrix analysis of the parameter extraction program. 1 Refs.

22/3,AB/24 (Item 4 from file: 8)  
DIALOG(R)File 8:Ei Compendex(R)  
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04746079

E.I. No: EIP97073724882

Title: Comparison of InGaAs absorptive **grating** structures in 1.55  $\mu\text{m}$  InGaAsP/InP strained MQW **gain-coupled DFB lasers**

Author: Funabashi, Masaki; Kawanishi, Hidekazu; Sudoh, Tsurugi K.; Nakura, Toru; Schmitz, Dietmar; Schulte, Frank; Nakano, Yoshiaki; Tada, Kunio

Corporate Source: Univ of Tokyo, Tokyo, Jpn

Conference Title: Proceedings of the 1997 International Conference on Indium Phosphide and Related Materials

Conference Location: Cape Cod, MA, USA Conference Date: 19970511-19970515

E.I. Conference No.: 46587

Source: Conference Proceedings - International Conference on Indium Phosphide and Related Materials 1997. IEEE, Piscataway, NJ, USA, 97CH36058. p 292-295

Publication Year: 1997

CODEN: CPRMEG

Language: English

Abstract: In **gain-coupled** (GC) distributed-feedback (**DFB**) **lasers** of absorptive **grating** type, the device characteristics depend very much on the absorptive **grating** configuration such as duty cycle, layer thickness, conduction type, and material composition. We have fabricated 1.55  $\mu\text{m}$  InGaAsP/InP strained multiple quantum well (MQW) **DFB lasers** having different absorptive **grating** thickness and different conduction type. Lasing characteristics of these lasers were compared in view of **coupling coefficients** and absorption saturation. Through net gain measurement, information useful for designing and optimizing the absorptive **grating** was obtained. (Author abstract) 6 Refs.

22/3,AB/25 (Item 5 from file: 8)  
DIALOG(R)File 8:Ei Compendex(R)

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04329974

E.I. No: EIP95112933568

Title: Single-lobed far-field radiation pattern from surface-emitting complex-coupled distributed-feedback diode lasers

Author: Kasraian, Masoud; Botez, Dan

Corporate Source: Univ of Wisconsin-Madison, Madison, WI, USA

Source: Applied Physics Letters v 67 n 19 Nov 6 1995. p 2783-2785

Publication Year: 1995

CODEN: APPLAB ISSN: 0003-6951

Language: English

Abstract: Some results of the theoretical analysis of an in-phase, complex-coupled distributed-feedback (DFB) laser with a second-order grating are presented. It is shown that the in-phase second-order complex-coupled DFB laser structure will fundamentally provide orthonormal emission of light having a single-lobed far-field radiation pattern as long as modal discrimination based on gain overlap factor is larger than that based on radiation losses. 35 Refs.

22/3,AB/26 (Item 6 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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04244275

E.I. No: EIP95092850453

Title: Gain-coupled strained layer MQW-DFB lasers with an essentially simplified fabrication process for  $\lambda$  equals 1.55  $\mu$ m

Author: Rast, A.; Johannes, T.W.; Harth, W.; Rieger, J.

Corporate Source: Technische Universitaet Muenchen, Muenchen, Ger

Source: IEEE Photonics Technology Letters v 7 n 8 Aug 1995. p 830-832

Publication Year: 1995

CODEN: IPTLEL ISSN: 1041-1135

Language: English

Abstract: A gain-coupled (GC) strained-layer (SL) multi-quantum-well (MQW) distributed-feedback (DFB) laser with a metallized surface grating and a substantially simplified fabrication process made by single-step epitaxy without corrugation overgrowth is described. The complex coupling coefficient can be adjusted by the contact metallization. Room-temperature single-mode continuous-wave (CW) operation with a threshold current of 22 mA, an output power of 20 mW, and a linewidth of 2.5 MHz is demonstrated. (Author abstract) 18 Refs.

22/3,AB/27 (Item 7 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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04204784

E.I. No: EIP95052693041

Title: New concept of single-mode resonator for distributed feedback semiconductor and fiber lasers

Author: Seminogov, Vladimir N.; Khudobenko, Alexander I.; Panchenko, Vladislav Y.; Sokolov, Victor I.

Corporate Source: Scientific Research Cent. for Technological Lasers, Troitsk, Moscow Region, Russia

Conference Title: Laser Diodes and Applications

Conference Location: San Jose, CA, USA Conference Date:  
19950208-19950210

E.I. Conference No.: 22231

Source: Proceedings of SPIE - The International Society for Optical  
Engineering v 2382 1995. Society of Photo-Optical Instrumentation  
Engineers, Bellingham, WA, USA. p 224-234

Publication Year: 1995

CODEN: PSISDG ISSN: 0277-786X ISBN: 0-8194-1729-7

Language: English

Abstract: The new concept of a single-mode resonator for single-frequency  
distributed feedback (DFB) **lasers** is presented. This concept is  
based on an embedded nonharmonic distributed Bragg structure with a  
sinusoidally modulated **coupling coefficient**, which is a  
combination of two superimposed sinusoidal Bragg gratings of equal heights  
and slightly different periods. Resonant frequencies and corresponding  
threshold gains of such a distributed resonator are calculated  
theoretically by using the coupled-mode theory. The designed resonator  
provides stable single-frequency oscillation and has lasing characteristics  
(frequencies and thresholds) very similar to those of a well-known  
distributed resonator with quarter-wavelength shift. The developed concept  
of a resonator with a sinusoidally modulated **coupling**  
**coefficient** can be applied both to semiconductor laser diodes with  
incorporated Bragg relief **grating** and to DFB fiber **lasers**  
with refractive index **grating**. The important advantage of designed  
new single-mode Bragg structure, as compared to quarter-wavelength-shifted  
structure, is that it can be fabricated very easily on semiconductor  
surfaces and in photosensitive fibers by direct three-beam holographic  
writing. 11 Ref.

22/3,AB/28 (Item 8 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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04082156

E.I. No: EIP95022583625

Title: Analysis and simulation of **gain coupled (GC)-DFB**  
**semiconductor lasers**

Author: Randone, Fabio; Montrosset, Ivo

Corporate Source: Politecnico di Torino, Torino, Italy

Conference Title: Proceedings of the 1994 IEEE LEOS Annual Meeting. Part  
1 (of 2)

Conference Location: Boston, MA, USA Conference Date: 19941031-19941103

E.I. Conference No.: 42506

Source: IEEE LEOS Annual Meeting - Proceedings v 1 1994. IEEE,  
Piscataway, NJ, USA, 94CH3371-2. p 105-106

Publication Year: 1994

CODEN: 001893

Language: English

Abstract: In this paper is presented a comparison between different GC-  
DFB **lasers** realized with an absorption or a gain or a second  
order **grating**. Light-current characteristics, FM response, linewidth,  
side mode suppression ratio are presented. (Author abstract) 4 Refs.

22/3,AB/29 (Item 9 from file: 8)

DIALOG(R)File 8:EI Compendex(R)

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03840764

E.I. No: EIP94041259342

Title: Frequency modulation characteristics of absorptive-grating gain-coupled DBF lasers - spatial hole burning self-suppression effect

Author: Sudoh, Tsurugi K.; Nakano, Yoshaiaki; Tada, Kunio; Kikuchi, Kazuro; Hirata, Takaaki; Hosomatsu, Haruo

Corporate Source: Univ of Tokyo, Tokyo, Jpn

Conference Title: Annual Meeting of the IEEE Lasers and Electro-Optics Society

Conference Location: San Jose, CA, USA Conference Date: 19931115-19931118

E.I. Conference No.: 19848

Source: Conference Proceedings - Lasers and Electro-Optics Society Annual Meeting 1993. Publ by IEEE, IEEE Service Center, Piscataway, NJ, USA, 93CH3297-9. p 572-573

Publication Year: 1993

ISBN: 0-7803-1263-5

Language: English

Abstract: The spatial hole burning (SHB) in distributed feed back (DBF) lasers limits longitudinal-mode stability and occasionally results in spectral linewidth broadening or multiple-mode oscillation. SHB may still exist in the gain-coupled (GC) DFB laser due to inappropriate coupling strength, parasitic index coupling, and facet reflection in practical devices. This paper describes self-suppression effect of SHB in absorptive-grating GC DFB lasers which is observed through the measurement of frequency modulation (FM) characteristics. This effect is attributed to the photon-density-dependent coupling coefficient in the gain-coupled cavity. 4  
Refs.

22/3,AB/30 (Item 1 from file: 34)

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

(c) 2004 Inst for Sci Info. All rts. reserv.

11751118 Genuine Article#: 690FZ Number of References: 7

Title: Characteristics of GaAs/AlGaAs quantum-wire distributed-feedback lasers with different gain modifications (ABSTRACT AVAILABLE)

Author(s): Kim TG (REPRINT)

Corporate Source: KwangWoon Univ, Dept Semicond & New Mat Engrg, Seoul

139701//South Korea/ (REPRINT); KwangWoon Univ, Dept Semicond & New Mat Engrg, Seoul 139701//South Korea/

Journal: JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 2003, V42, N6 (JUN), P 791-794

ISSN: 0374-4884 Publication date: 20030600

Publisher: KOREAN PHYSICAL SOC, 635-4, YUKSAM-DONG, KANGNAM-KU, SEOUL 135-703, SOUTH KOREA

Language: English Document Type: ARTICLE

Abstract: GaAs/AlGaAs quantum-wire (QWR) gain-coupled distributed-feedback (GC-DFB) lasers were fabricated and characterized. Interestingly, as the shape of the active grating was varied, the lasing characteristics changed greatly; for example, one laser with sharp gratings lased at a threshold current of 13 mA while another one with dull gratings lased at 230 mA. This may be due to a change in the gain coupling coefficient with the shape of the QWR active grating. Little observation of the stopband and the wavelength consistency between the lasing and the photoluminescence peaks of the QWRs also provided evidence for lasing via GC-DFB effects in these devices.



22/3,AB/31 (Item 2 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
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11587941 Genuine Article#: 6712M Number of References: 25  
Title: Numerical simulation of a pulsed laser pumped distributed-feedback waveguided dye laser by coupled-wave theory (ABSTRACT AVAILABLE)  
Author(s): Zuo DL (REPRINT) ; Oki Y; Maeda M  
Corporate Source: Huazhong Univ Sci & Technol, State Key Lab Laser Technol, Wuhan 430074//Peoples R China/ (REPRINT); Kyushu Univ, Grad Sch Informat Sci & Elect Engr, Fukuoka 8128581//Japan/  
Journal: IEEE JOURNAL OF QUANTUM ELECTRONICS, 2003, V39, N5 (MAY), P673-680  
ISSN: 0018-9197 Publication date: 20030500  
Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC, 345 E 47TH ST, NEW YORK, NY 10017-2394 USA  
Language: English Document Type: ARTICLE  
Abstract: A dynamic model of pulsed laser pumped distributed-feedback

(DFB) waveguided dye laser based on a coupled-wave theory is described. Due to the periodical distribution of the intensities of pump I source and stimulated emission along the waveguide, the rate equations of the population densities are turned into the equations of the Fourier coefficients. Coupled-wave equations of optical fields are used to simulate the laser oscillation. Besides the temporal evolution of the output intensity, the spectra can also be obtained by the Fourier transform of the optical fields. Two different configurations of the waveguided dye laser, prefabricated DFB (mainly index coupling), first- and second-order holographic DFB (dynamic gain-coupling), are considered in the model. The simulation shows that: 1) the temporal waveforms of the holographic DFB consist of sharp spikes; 2) the broadened spectral widths resulted from the possible nonuniformities in propagation constant or grating period are less than 50 pm except for the second-order holographic DFB; and 3) strong parasitic oscillations can be observed in the second-order holographic DFB with terminal reflection. These results and the comparisons of some of them to the experiments are reported.

22/3,AB/32 (Item 3 from file: 34)  
DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
(c) 2004 Inst for Sci Info. All rts. reserv.

10615144 Genuine Article#: 547LZ Number of References: 26  
Title: Electroabsorption modulated laser for long transmission spans (ABSTRACT AVAILABLE)  
Author(s): Salvatore RA (REPRINT) ; Sahara RT; Bock MA; Libenzon I  
Corporate Source: Corning Lasertron, Bedford//MA/01730 (REPRINT); Corning Lasertron, Bedford//MA/01730  
Journal: IEEE JOURNAL OF QUANTUM ELECTRONICS, 2002, V38, N5 (MAY), P464-476  
ISSN: 0018-9197 Publication date: 20020500  
Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC, 345 E 47TH ST, NEW YORK, NY 10017-2394 USA  
Language: English Document Type: ARTICLE  
Abstract: Strain-compensated AlGaInAs quantum-well electroabsorption modulated lasers (EMLs) transmit at 10 Gbits/s on uncompensated transmission spans of >75 km of standard fiber and >225 km of MetroCor fiber. Details of the design, fabrication, and testing are presented, A complex-coupled distributed feedback (DFB) grating is used to enable high output power. The epitaxy and chip structure are described.

The paper studies what is needed to accomplish long-span transmission in terms of minimum physical requirements for laser mode control, facet reflection, index **grating** strength, laser-modulator matching, laser-modulator electrical isolation, modulator extinction ratio, modulator capacitance, linewidth enhancement factor, etc. The interaction of the modulator with the laser is analyzed and a requirement for this structure is computed for the electrical isolation resistance between modulator and laser contacts. Stability of the laser source is discussed and a method is derived for determining the **grating's gain-coupling coefficient** at operating power. Chirp due to the modulator is analyzed. Nonzero chirp of the modulator is shown to have beneficial impact on the quality of the signal after transmission. The effect of a bias-dependent alpha parameter is analyzed. Because bit-error rate is a strong function of mean alpha parameter and not a strong function of the range of alpha during nonreturn-to-zero modulation, we determine that tuning the chirp of the EML modulator to suit different fiber types (MetroCor, SMF-28, etc.) is practical. Specific tradeoffs are also required. Experimental results verify the analysis.

22/3,AB/33 (Item 4 from file: 34)  
 DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
 (c) 2004 Inst for Sci Info. All rts. reserv.

09321656 Genuine Article#: 390UU Number of References: 24  
 Title: Second- and higher order resonant gratings with gain or loss - Part I: Green's function analysis (ABSTRACT AVAILABLE)  
 Author(s): Shams-Zadeh-Amiri AM (REPRINT) ; Hong J; Li X; Huang WP  
 Corporate Source: Univ Waterloo,Dept Elect & Comp Engn,Waterloo/ON N2L 3G1/Canada/ (REPRINT); Univ Waterloo,Dept Elect & Comp Engn,Waterloo/ON N2L 3G1/Canada/; Nortel Networks,Ottawa/ON/Canada/; McMaster Univ,Dept Elect & Comp Engn,Hamilton/ON L8S 4L8/Canada/  
 Journal: IEEE JOURNAL OF QUANTUM ELECTRONICS, 2000, V36, N12 (DEC), P 1421-1430  
 ISSN: 0018-9197 Publication date: 20001200  
 Publisher: IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC, 345 E 47TH ST, NEW YORK, NY 10017-2394 USA  
 Language: English Document Type: ARTICLE  
 Abstract: This paper addresses a systematic method for obtaining the **coupling coefficients** due to diffraction orders less than the **grating** order of second- and higher order resonant complex gratings in a multilayer structure. This method is based on an improved Green's function, and its distinguishing feature is its use of the transfer matrix method to simplify the theoretical analysis for obtaining the Green's function in multilayer structures. More importantly, it is also shown that by introducing gain or loss in second- and higher order resonant gratings, the range of controlling the total **coupling coefficient** becomes wider than those in first-order complex gratings or second-order index gratings, Concepts like in-phase and anti-phase gratings are generalized in this type of **grating**. Finally, guidelines for designing complex-coupled DFB lasers with second- and third-order **grating** are also presented.

22/3,AB/34 (Item 5 from file: 34)  
 DIALOG(R)File 34:SciSearch(R) Cited Ref Sci  
 (c) 2004 Inst for Sci Info. All rts. reserv.

07661366 Genuine Article#: 193KE Number of References: 10  
Title: 1.5  $\mu$ m InGaAsP/InP strained MQW **gain-coupled DFB**  
**laser** with an improved periodically modulated injection-carrier  
**grating** (ABSTRACT AVAILABLE)  
Author(s): Luo Y (REPRINT); Wen GP; Gan YN; Zhang KQ; Sudoh TK; Sudo S;  
Nakano Y; Tada K  
Corporate Source: TSING HUA UNIV, DEPT ELECT ENGN/BEIJING 100084//PEOPLES R  
CHINA/ (REPRINT); UNIV TOKYO, DEPT ELECT ENGN/TOKYO 113//JAPAN/  
Journal: JOURNAL OF THE KOREAN PHYSICAL SOCIETY, 1999, V34, S (APR), P  
S101-S103  
ISSN: 0374-4884 Publication date: 19990400  
Publisher: KOREAN PHYSICAL SOC, 635-4, YUKSAM-DONG, KANGNAM-KU, SEOUL  
135-703, SOUTH KOREA  
Language: English Document Type: ARTICLE  
Abstract: A 1.55  $\mu$ m InGaAsP/InP strained multiple quantum well (MQW)  
distributed feedback (DFB) **laser** with an improved  
periodically modulated injection-carrier **grating** is reported for  
the first time. In this laser structure, the effect of current blocking  
**grating** is enhanced by optimizing the doping level of its  
surrounding layers, therefore, large **gain coupling**  
**coefficient** can be expected. The device is fabricated by hybrid  
growth of MOVPE and LPE. A single-mode oscillation yield as high as 80  
% is achieved under the condition of two cleaved facets.

22/3, AB/35 (Item 6 from file: 34)  
DIALOG(R) File 34: SciSearch(R) Cited Ref Sci  
(c) 2004 Inst for Sci Info. All rts. reserv.

05024547 Genuine Article#: UZ510 Number of References: 6  
Title: **COUPLING-COEFFICIENTS OF GAIN-COUPLED**  
**DISTRIBUTED-FEEDBACK LASERS WITH ABSORPTIVE GRATING** (Abstract  
Available)  
Author(s): CHEN CH; CHEN LH; WANG QM  
Corporate Source: CHINESE ACAD SCI, INST SEMICON, NIOEL, POB 912/BEIJING  
100083//PEOPLES R CHINA/  
Journal: ELECTRONICS LETTERS, 1996, V32, N14 (JUL 4), P1288-1290  
ISSN: 0013-5194  
Language: ENGLISH Document Type: ARTICLE  
Abstract: An effective coupling efficient is introduced for **gain-**  
**coupled** distributed feedback lasers with absorptive **grating**  
. When radiation and other partial wave coupling effects are  
considered, the effective **coupling coefficient** will change  
significantly. In some cases, it will become real, although both loss  
and index coupling are presented.

22/3, AB/36 (Item 7 from file: 34)  
DIALOG(R) File 34: SciSearch(R) Cited Ref Sci  
(c) 2004 Inst for Sci Info. All rts. reserv.

04218674 Genuine Article#: RP038 Number of References: 18  
Title: **GAIN-COUPLED STRAINED-LAYER MQW-DFB LASERS**  
**WITH AN ESSENTIALLY SIMPLIFIED FABRICATION PROCESS FOR LAMBDA=1.55 MU-M**  
(Abstract Available)  
Author(s): RAST A; JOHANNES TW; HARTH W; RIEGER J  
Corporate Source: TECH UNIV MUNICH, LEHRSTUHL ALLGEMEINE ELEKTROTECH & ANGEW  
ELEKTR/D-80290 MUNICH//GERMANY//; SIEMENS AG, ZFE/D-81730  
MUNICH//GERMANY/  
Journal: IEEE PHOTONICS TECHNOLOGY LETTERS, 1995, V7, N8 (AUG), P830-832

ISSN: 1041-1135

Language: ENGLISH Document Type: ARTICLE

Abstract: A **gain-coupled** (GC) strained-layer (SL) multi-quantum-well (MQW) distributed-feedback (DFB) **laser** with a metallized surface **grating** and a substantially simplified fabrication process made by single-step epitaxy without corrugation overgrowth is described. The complex **coupling coefficient** can be adjusted by the contact metallization. Room-temperature single-mode continuous-wave (CW) operation with a threshold current of 22 mil, an output power of 20 mW, and a linewidth of 2.5 MHz is demonstrated.

22/3,AB/37 (Item 8 from file: 34)

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

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01742523 Genuine Article#: HX435 Number of References: 14

Title: REDUCTION OF EFFECTIVE LINEWIDTH ENHANCEMENT FACTOR-ALPHA-EFF OF  
DFB LASERS WITH COMPLEX **COUPLING-COEFFICIENTS**

(Abstract Available)

Author(s): KUDO K; SHIM JI; KOMORI K; ARAI S

Corporate Source: TOKYO INST TECHNOL,DEPT PHYS ELECTR/TOKYO 152//JAPAN/

Journal: IEEE PHOTONICS TECHNOLOGY LETTERS, 1992, V4, N6 (JUN), P531-534

Language: ENGLISH Document Type: ARTICLE

Abstract: The effective linewidth enhancement factor  $\alpha(\text{eff})$  of **DFB lasers** which have both **gain** and index **coupling coefficients** is theoretically analyzed. The unique reduction mechanism of  $\alpha(\text{eff})$  due to the optical negative feedback of modal phase and modal **gain** in **gain coupled DFB lasers** was found for the first time. The numerical result showed that  $\alpha(\text{eff})$  can be reduced to almost one half of material defined linewidth enhancement factor- $\alpha$  when there exists an index **coupling coefficient** comparable to the **gain coupling coefficient**.

22/3,AB/38 (Item 9 from file: 34)

DIALOG(R)File 34:SciSearch(R) Cited Ref Sci

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01412510 Genuine Article#: GX354 Number of References: 9

Title: INGAAS INP **GAIN-COUPLED** DISTRIBUTED FEEDBACK LASER WITH

A CORRUGATED ACTIVE LAYER (Abstract Available)

Author(s): INOUE T; NAKAJIMA S; LUO Y; OKI T; IWAOKA H; NAKANO Y; TADA K

Corporate Source: OPT MEASUREMENT TECHNOL DEV CO LTD,2-11-13

NAKACHO/MUSASHINO/TOKYO 180/JAPAN//; UNIV TOKYO,DEPT ELECTR ENGN,BUNKYO  
KU/TOKYO 113//JAPAN/

Journal: JAPANESE JOURNAL OF APPLIED PHYSICS PART 2-LETTERS, 1991, V30,  
N10B (OCT 15), PL1808-L1810

Language: ENGLISH Document Type: ARTICLE

Abstract: With InGaAs/InP materials, we have fabricated **gain-coupled** distributed feedback lasers having **grating** corrugation on the active layer itself, using two-step organometallic vapor phase epitaxy. Single longitudinal mode properties have been achieved. Self-consistent calculation of **coupling coefficients** and threshold gain difference for these lasers has also been carried out.

22/3,AB/39 (Item 1 from file: 35)  
DIALOG(R)File 35:Dissertation Abs Online  
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01729908 AADAAI9953466

A new and efficient theoretical model to analyze chirped **grating**  
distributed feedback lasers

Author: Arif, Muhammad

Degree: Ph.D.

Year: 1999

Corporate Source/Institution: The University of Dayton (0327)

Source: VOLUME 61/01-B OF DISSERTATION ABSTRACTS INTERNATIONAL.

PAGE 344. 117 PAGES

Threshold conditions of a distributed feedback (DFB) **laser** with a linearly chirped **grating** are investigated using a new and efficient method. DFB **laser** with chirped **grating** is found to have significant effects on the lasing characteristics. The coupled wave equations for these lasers are derived and solved using a power series method to obtain the threshold condition. A Newton-Raphson routine is used to solve the threshold conditions numerically to obtain threshold gain and lasing wavelengths. To prove the validity of this model, it is applied to both conventional index-coupled and complex-coupled DFB **lasers**. The threshold gain margins are calculated as functions of the ratio of the **gain coupling** to index coupling

( $|\kappa_g|/|\kappa_n|$ ), and the phase difference between the index and gain gratings. It was found that for **coupling coefficient**  $|\kappa_l| < 0.9$ , the laser shows a mode degeneracy at particular values of the ratio  $|\kappa_g|/|\kappa_n|$ , for cleaved facets. We found that at phase differences  $\pi/2$  and  $3\pi/2$ , between the gain and index **grating**, for an AR-coated complex-coupled laser, the laser becomes multimode and a different mode starts to lase. We also studied the effect of the facet reflectivity (both magnitude and phase) on the gain margin of a complex-coupled DFB **laser**. Although, the gain margin varies slowly with the magnitude of the facet reflectivity, it shows large variations as a function of the phase. Spatial hole burning was found to be minimum at phase difference  $n\pi$ ,  $n = 0, 1, \dots$  and maximum at phase differences  $\pi/2$  and  $3\pi/2$ . The single mode gain margin of an index-coupled linearly chirped CG-DFB is calculated for different chirping factors and coupling constants. We found that there is clearly an optimum chirping for which the single mode gain margin is maximum. The gain margins were calculated also for different positions of the cavity center. The effect of the facet reflectivities and their phases on the gain margin was investigated. We found the gain margin is maximum and the Spatial Hole Burning (SHB) is minimum for the cavity center at the middle of the laser cavity. Effect of chirping on the threshold gain, gain margin and spatial hole burning (SHB) for different parameters, such as the **coupling coefficients**, facet reflectivities, etc., of these lasers are studied. Single mode yield of these **lasers** are calculated and compared with that of a uniform **grating DFB laser**.

22/3,AB/40 (Item 2 from file: 35)  
DIALOG(R)File 35:Dissertation Abs Online  
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01680786 AADNQ32994

MODELLING AND ANALYSIS OF **GAIN-COUPLED DFB SEMICONDUCTOR LASERS** (FIBER OPTICS, DISTRIBUTED FEEDBACK)

Author: CHEN, JIANYAO

Degree: PH.D.

Year: 1997

Corporate Source/Institution: ECOLE POLYTECHNIQUE, MONTREAL (CANADA) (1105)

Source: VOLUME 59/12-B OF DISSERTATION ABSTRACTS INTERNATIONAL.  
PAGE 6368. 179 PAGES

ISBN: 0-612-32994-1

With the unique features of compact size and a built-in frequency selective element, the distributed feedback (**DFB**) semiconductor **lasers** are presently the most promising light sources in optical fiber communications systems. The recently introduced **gain coupling** and multielectrode modulation provide new possibilities for the improvement of that laser. The aim of this dissertation is to develop a comprehensive and versatile numerical tool for the efficient and accurate simulation of those delicate devices and, through rigorous modelling and analysis, to reveal various salient features of **gain-coupled DFB lasers**.

Based on the standing wave formalism, the coupled mode method and the Green's function analysis are used in this thesis to study **gain-coupled DFB lasers**. By separating the temporal and spatial dependencies of the modal fields in the lasers, the approach possesses a unique advantage of producing simple and insightful closed form results which help gain physical understanding into the laser operation. With the help of the spatially dependent rate equations, a self-consistent, multimode, full bias range (from below to above threshold) model has been developed for complex-coupled **DFB lasers** including multielectrode modulation. The detailed analysis of this thesis covers a wide range investigation of **gain-coupled DFB laser** physics. Using the Bloch wave analysis, the condition of single mode oscillation in **gain-coupled DFB lasers** has been explained intuitively and the significant effect of unequal section lengths in the gain **grating** on the single-mode gain margin has also been revealed for the first time. Based on the spatially dependent multimode rate equations developed in this thesis, the static and dynamic characteristics of the lasing mode and of the side modes of **gain-coupled DFB lasers** are investigated in detail. The study has also been successfully extended to the analysis of multielectrode push-pull **DFB lasers** to include the modal interference effect for the first time. Through the study of the role of the complex **coupling coefficient** and the various spatial features, an in-depth understanding of the high yield, high power, high speed, high side mode suppression, low threshold, low frequency chirp, and low harmonic distortion in **gain-coupled DFB lasers** has also been reached.

22/3,AB/41 (Item 3 from file: 35)

DIALOG(R)File 35:Dissertation Abs Online

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01428297 AADAAI9526844

PART I: LONGITUDINAL STATIC AND DYNAMIC EFFECTS IN SEMICONDUCTOR LASERS.

PART II: SPECTRAL CHARACTERISTICS OF PASSIVELY MODE-LOCKED QUANTUM WELL

LASERS (CHIRP, FEMTOSECOND LASER)

Author: SCHRANS, THOMAS PIERRE

Degree: PH.D.

Year: 1994

Corporate Source/Institution: CALIFORNIA INSTITUTE OF TECHNOLOGY (0037)

Source: VOLUME 56/04-B OF DISSERTATION ABSTRACTS INTERNATIONAL.

PAGE 2230. 224 PAGES

In the first part of this thesis a static model for above threshold operation of a single mode laser, consisting of multiple active and passive sections, is developed by calculating the longitudinal optical intensity and electron density distribution in a self-consistent manner. Feedback from an index and gain **grating** is included, as well as feedback from discrete reflections at interfaces and facets. Longitudinal spatial holeburning is analyzed by including the dependence of the gain and the refractive index on the electron density. The mechanisms of spatial holeburning in quarter wave shifted **DFB lasers** are analyzed. A new laser structure with a uniform optical intensity distribution is introduced and an implementation is simulated, resulting in a large reduction of the longitudinal spatial holeburning effect.

A dynamic small-signal model is then developed by including the optical intensity and electron density distribution, as well as the dependence of the **grating coupling coefficients** on the electron density. Expressions are derived for the intensity and frequency noise spectrum, the spontaneous emission rate into the lasing mode, the linewidth enhancement factor, and the AM and FM modulation response. Different chirp components are identified in the FM response, and a new adiabatic chirp component is discovered. This new adiabatic chirp component is caused by the nonuniform longitudinal distributions, and is found to dominate at low frequencies. Distributed feedback lasers with partial **gain coupling** are analyzed, and it is shown how the dependence of the **grating coupling coefficients** on the electron density can result in an enhancement of the modulation bandwidth and a reduction in chirp.

In the second part, spectral characteristics of passively mode-locked two-section multiple quantum well laser coupled to an external cavity are studied. Broad-band wavelength tuning using an external **grating** is demonstrated for the first time in passively mode-locked semiconductor lasers. A record tuning range of 26 nm is measured, with pulse widths of typically a few picosecond and time-bandwidth products of more than 10 times the transform limit. These large time-bandwidth products are due to a strong linear upchirp, and pulse compression by a factor of 15 is demonstrated to a record low pulse widths of 320 fs.

A model for pulse propagation through a saturable medium with self-phase-modulation, due to the  $\alpha$ -parameter, is developed for quantum well material, including the frequency dependence of the gain medium. This model is used to simulate two-section devices coupled to an external cavity. A linear upchirp is imposed on the pulse, due to a combination of self-phase-modulation in the gain section and absorption of the leading edge of the pulse in the saturable absorber.

22/3,AB/42 (Item 1 from file: 94)

DIALOG(R)File 94:JICST-EPlus

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01425138 JICST ACCESSION NUMBER: 92A0108546 FILE SEGMENT: JICST-E

Analysis of **Gain-Coupled DFB Lasers** with Absorptive

Gratings for Their Low Threshold Operation.

NAKANO YOSHIAKI (1); TADA KUNIO (1); CAO H L (1); INOUE TAKESHI (2); LUO Y (2)

(1) Univ. of Tokyo, Faculty of Engineering; (2) Optical Measurement Technology Development Co., Ltd.

Denshi Joho Tsushin Gakkai Gijutsu Kenkyu Hokoku (IEIC Technical Report  
(Institute of Electronics, Information and Communication Engineers),  
1991, VOL.91, NO.402 (OQE91 132-150), PAGE.19-24, FIG.4, REF.11  
JOURNAL NUMBER: S0532BBG  
UNIVERSAL DECIMAL CLASSIFICATION: 621.375.826:621.315.592  
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan  
DOCUMENT TYPE: Journal  
ARTICLE TYPE: Original paper  
MEDIA TYPE: Printed Publication

22/3, AB/43 (Item 2 from file: 94)  
DIALOG(R) File 94: JICST-EPlus  
(c) 2004 Japan Science and Tech Corp (JST). All rts. reserv.

01006137 JICST ACCESSION NUMBER: 90A0166011... FILE SEGMENT: JICST-E  
**Gain-coupled DFB semiconductor laser having**  
corrugated active layer.  
LUO Y (1); NAKANO Y (1); TADA K (1); INOUE T (2); HOSOMATSU H (2); IWAOKA H  
(2)  
(1) Univ. Tokyo, Tokyo, JPN; (2) Optical Measurement Technology Development  
Co. Ltd., Tokyo, JPN  
Tech Dig IOOC 89, 1989, PAGE.723-724, FIG.5, REF.3  
JOURNAL NUMBER: K19890583H  
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LANGUAGE: English COUNTRY OF PUBLICATION: Japan  
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ARTICLE TYPE: Original paper  
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22/3, AB/44 (Item 1 from file: 144)  
DIALOG(R) File 144: Pascal  
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16146147 PASCAL No.: 03-0300353  
Numerical simulation of a pulsed laser pumped distributed-feedback  
waveguided dye laser by coupled-wave theory  
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State Key Laboratory of Laser Technology, Huazhong University of Science  
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Journal: IEEE journal of quantum electronics, 2003, 39 (5) 673-680  
Language: English  
A dynamic model of pulsed laser pumped distributed-feedback (DFB) waveguided dye laser based on a coupled-wave theory is described. Due to the periodical distribution of the intensities of pump source and stimulated emission along the waveguide, the rate equations of the population densities are turned into the equations of the Fourier coefficients. Coupled-wave equations of optical fields are used to simulate the laser oscillation. Besides the temporal evolution of the output intensity, the spectra can also be obtained by the Fourier transform of the optical fields. Two different configurations of the waveguided dye laser, prefabricated DFB (mainly index coupling), first- and second-order holographic DFB (dynamic gain-coupling), are considered in the model. The simulation shows that: 1) the temporal waveforms of the holographic DFB consist of sharp spikes; 2) the broadened spectral widths resulted from the possible nonuniformities in propagation constant or grating period are less than 50 pm except for the



second-order holographic DFB; and 3) strong parasitic oscillations can be observed in the second-order holographic DFB with terminal reflection. These results and the comparisons of some of them to the experiments are reported.

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22/3,AB/45 (Item 1 from file: 350)  
DIALOG(R)File 350:Derwent WPIX  
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016085688

WPI Acc No: 2004-243563/200423

XRFX Acc No: N04-193248

Gain knot-pattern distributed feedback type semiconductor laser for optical communication system, has diffraction **grating** in which recess is embedded by buried layer with high refractive index than cladding layer

Patent Assignee: FUJITSU LTD (FUIT )

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
JP 2004055797	A	20040219	JP 2002210785	A	20020719	200423 B

Priority Applications (No Type Date): JP 2002210785 A 20020719

Patent Details:

Patent No	Kind	Lan Pg	Main IPC	Filing Notes
JP 2004055797	A	15	H01S-005/12	

Abstract (Basic): JP 2004055797 A

Abstract (Basic):

NOVELTY - A cladding layer (3) covers the outermost surface of protrusion in diffraction **grating** (4). The recess of diffraction **grating** is embedded by a P/N type buried layer (5) with higher refractive index than the cladding layer.

USE - Gain knot-pattern distributed feed back (DFB) type semiconductor laser used as light source of optical communication system.

ADVANTAGE - Since the diffraction **grating** recess is embedded by buried layer with higher refractive index, high **gain coupling coefficient** is achieved, stable single wavelength operation of high output and big reflective return light resistance are achieved. Improves speed and efficiency of the laser.

DESCRIPTION OF DRAWING(S) - The figure shows an explanatory drawing of the Gain knot-pattern **DFB** semiconductor laser. (Drawing includes non-English language text).

cladding layers (1,3)

active region (2)

diffraction **grating** (4)

P/N type buried layer (5)

pp; 15 DwgNo 1/10

22/3,AB/46 (Item 2 from file: 350)  
DIALOG(R)File 350:Derwent WPIX  
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013270569

WPI Acc No: 2000-442475/200038

XRPX Acc No: N00-330155

**Gain coupled** distributed feedback semiconductor laser in fiber optics communication system, has complex coupled **grating** formed on substrate by etching grooves along cavity length direction in active region

Patent Assignee: NORTEL NETWORKS LTD (NELE ); NORTEL NETWORKS CORP (NELE )

Inventor: HONG J; MAKINO T

Number of Countries: 027 Number of Patents: 003

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
WO 200036717	A1	20000622	WO 99CA1067	A	19991110	200038 B
EP 1055272	A1	20001129	EP 99973441	A	19991110	200063
			WO 99CA1067	A	19991110	
JP 2002532907	W	20021002	WO 99CA1067	A	19991110	200279
			JP 2000588867	A	19991110	

Priority Applications (No Type Date): US 98209977 A 19981211

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
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WO 200036717	A1	E	40	H01S-005/12	
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Designated States (National): CA JP

Designated States (Regional): AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE

EP 1055272	A1	E		H01S-005/12	Based on patent WO 200036717
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Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI

JP 2002532907	W		35	H01S-005/12	Based on patent WO 200036717
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Abstract (Basic): WO 200036717 A1

Abstract (Basic):

NOVELTY - A high order complex coupled **grating** (18) is formed by etching several grooves which provide gain of modulation in the active region (14) along the cavity length direction, on the substrate (12). The shape of the grooves, and the order and duty cycle of the **grating** are defined to provide a predetermined ratio of gain/loss to index **coupling coefficients**.

DETAILED DESCRIPTION - The predetermined ratio of gain/loss to index coupling is defined by the depth of etching. Contact electrodes (24,26) defined on the ridge (22) and at the bottom of the substrate (12) respectively inject current into the active region (14).

An INDEPENDENT CLAIM is also included for the production of a complex coupled **DFB semiconductor laser**.

USE - In fiber optic communication systems.

ADVANTAGE - As the predetermined ratio of gain is provided to index coupling by forming **grating**, a **DFB laser** with high efficiency, yield, single mode operation and side mode suppression ratio is efficiently produced. The need for deep etching to obtain strong index coupling is eliminated. High order lasers can be easily manufactured because of the larger period of gratings.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic cross-sectional view of the **DFB laser**.

Substrate (12)

Active region (14)

**Grating** (18)

Ridge (22)

Contact electrodes (24,26)

pp; 40 DwgNo 1/10

22/3,AB/47 (Item 1 from file: 347)  
DIALOG(R)File 347:JAPIO  
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07080804

SEMICONDUCTOR LIGHT EMITTING ELEMENT

PUB. NO.: 2001-308451 [JP 2001308451 A]  
PUBLISHED: November 02, 2001 (20011102)  
INVENTOR(s): ISHIKAWA TSUTOMU  
KOBAYASHI HIROHIKO  
YAMAMOTO TAKAYUKI  
SHOJI HAJIME  
APPLICANT(s): FUJITSU LTD  
APPL. NO.: 2000-121436 [JP 2000121436]  
FILED: April 21, 2000 (20000421)

#### ABSTRACT

PROBLEM TO BE SOLVED: To realize a semiconductor light emitting element with excellent wavelength stability capable of preventing the generation of any wavelength jump even in the case of the generation of modulation in a high output or reflected return lights.

SOLUTION: In a semiconductor light emitting element in an MQW diffraction grating structure to be used mainly for a gain coupling DFB laser, the well layer of an MQW-A is made thicker than that of the well layer of an MQW-B so that the rate of a gain coupling coefficient to a refractivity coupling coefficient can be increased. The well layer and barrier layer of the MQW structure 2 are respectively constituted of GaInAsP whose compositions are different.

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## Query/Command : HIS

File : PLUSPAT

## SS Results


1	1	US20030103538/PN
2	1	(1) ..FAM US20030103538/PN
3	1	..CITF US20030103538/PN
4	1	..CITB US20030103538/PN

Search statement 5

## Query/Command : PRT MAX SET

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1 / 1 PLUSPAT - ©QUESTEL-ORBIT - image

**PN** -  US2003103538 A1 20030605 [US20030103538]  
**TI** - (A1) Enhanced link operation of directly modulated lasers using gain-coupled gratings  
**PA** - (A1) AR CARD (US)  
**PA0** - AR card  
**IN** - (A1) WHITE JOHN KENTON (CA)  
**AP** - US2586601 20011226 [2001US-0025866]  
**FD** - Provisional: US 60334013 - 20011128 [2001US-P334013]  
**PR** - US2586601 20011226 [2001US-0025866]  
US33401301P 20011128 [2001US-P334013]  
**IC** - (A1) H01S-003/08 H01S-005/00  
**EC** - H01S-005/12G  
**PCL** - ORIGINAL (O) : 372045000; CROSS-REFERENCE (X) : 372096000  
**DT** - Basic  
**STG** - (A1) Utility Patent Application published on or after January 2, 2001  
**AB** - Increasing the gain-coupling of a DFB directly modulated semiconductor laser permits the output response to be overdamped without lowering the relaxation oscillation frequency of the output. The overdamping permits the laser to operate at modulation frequencies which approach the relaxation oscillation frequency with satisfactory error performance. The performance improvement is sufficient to permit operation of the laser in an uncooled environment.  
**UP** - 2003-25

Search statement 2